

Course Plan/Profile

1. Course No: EE 3122 Contact hours: 3/2Hrs/Week
2. Course Title: Sessional on EE 3122
3. Course Teacher: Dr. Mohiuddin Ahmad & Dr. Md. Rejvi Kaysir

4. Course Content:

Laboratory Experiments based on EE 3121

Content of EE 3121 (Numerical methods & Statistics)

Computer Application to Numerical Methods: Solution of Algebraic and Transcendental Equations, Half interval search, Method of false opposition, Newton-Raphson method, Method of iteration, Solution of polynomial equations, Solution of systems of linear equation, Cramer's rule, Gam's equation method, Gauss's-Seidel method.

Interpolation: Forward difference and backward difference, Lagrange's interpolation formula.

Numerical differentiation: Use of Newton's interpolation formulas.

Numerical integration: Trapezoidal rule, and Simpson's rule.

Solution of differential equation: Picard's methods, Runge-Kutta method, and Finite difference method.

Statistical Analyses: Frequency and frequency distribution and its graphical representation. Measures of central tendency, mean, media, & mode, Index number, variance, mean deviation, standard deviation, quartile deviation, time series analyses.

Probability: Probability function and probability distribution: Normal distribution, Poisson's distribution, and binomial distribution. Theory of error and Gaussian law of error. Arithmetic Mean, Geometric Mean and Harmonic Mean, Moment Skewness and Kurtosis, Moments for grouped data, Relation between moments and grouped data.

Curve Fitting: Relationship between variables; Equations of approximating curves. The straight line; the method of least squares, the least square line on linear relationship. The least square parabola. Regression Application to time series. Problem involving two or more variable.

Correlation Theory: Correlation and regression. Linear correlation, Measures of correlation. The least square regression lines. Standard error of estimate. Explained and Unexplained variation. Coefficient of correlation. Remarks concerning the correlation coefficient. Product-moment formula for the linear correlation coefficient. Rank correlation formulae. Regression lines and the linear correlation coefficient. Sampling theory of correlation. Sampling theory of regression.

5. Learning Outcome:

The *Numerical Methods* component will enable you to understand how mathematical models of problems arising in Engineering (and other areas) can be solved numerically. At the end of this course, you will be able to

- Solve large systems of simultaneous linear equations.
- Find solutions of nonlinear equations using the bisection method, Newton's methods, and secant method and implement using a computer.
- Estimate the solutions of systems of first-order ordinary differential equations or higher order ordinary differential equations using various numerical methods and implement using a computer.
- Apply these techniques to practical problems in Engineering.
- Use Matlab/C/C++ for the implementation and application of numerical methods and the visualization of results

The *Statistics* component will enable you to understand the various ways in which random variation arises in engineering contexts and to develop a facility at:

- Applying various graphical and data analysis methods for summarizing and understanding data;
- Applying various statistical models and methods for drawing conclusions and making decisions under uncertainty in engineering contexts; and,
- Applying Matlab/C/C++ for graphical and statistical analysis.

6. Laboratory Schedule:

Expt.#	Name of the experiment & Objectives
01	Statistical analysis of data <ul style="list-style-type: none"> ➤ <i>Read data (.txt / .xls/.xlsx) from a file and write data to another format of the file</i> ➤ <i>Convert ungrouped data into grouped data</i> ➤ <i>Calculate the number of data in a column and/or row of a file (.txt/.xls)</i> ➤ <i>Calculate mean (AM, GM, HM), mode, median, from grouped and ungrouped data</i> ➤ <i>Calculate mean, standard, and quartile deviation, variance from grouped and ungrouped data</i> ➤ <i>Calculate the moment of a Distribution: Mean, variance, Skewness, Kurtosis</i>
02	Solution of Equations <ul style="list-style-type: none"> ➤ <i>Solutions of algebraic and transcendental equations</i> ➤ <i>Solutions by Gaussian elimination / Gaussian elimination with Row pivoting</i> ➤ <i>Gauss-Seidel method</i>
03	Find the roots of non-linear equations <ul style="list-style-type: none"> ➤ <i>Use the bisection method</i> ➤ <i>Use False position method</i> ➤ <i>Use the Newton Raphson method</i> ➤ <i>Use the Secant method</i>
04	Numerical differentiation and integration <ul style="list-style-type: none"> ➤ <i>Differentiation by Newton's interpolation formula</i> ➤ <i>Differentiation by forward/ backward/ central divided difference formula</i> ➤ <i>Integration by Trapezoidal rule</i> ➤ <i>Integration by Simpson's 1/3 and 3/8 rule</i>
05	Curve fitting & Correlation <ul style="list-style-type: none"> ➤ <i>Least square regression (line fitting), Least square parabola</i> ➤ <i>Fitting transcendental equation</i> ➤ <i>Linear correlation and Rank correlation</i>
06	The students must submit a project on the contents of EE 3121. They can use any code: C/C++/Matlab for completing their project. The format will be given later. The submission date: within 13th Cycle of the term.

7. Date of Class Test/Quiz: 13th Week of the Term

8. Teaching Methodology/Strategy: Lecture (Whiteboard/slide), Computer programming practice based on the experiments, Questions, answers, and Discussions.

9. Text Book:

- (1) Numerical Recipes in C/C++, by W. H. Press, Teukolsky, Vetterling, & Flannery, Cambridge Univ. Press
- (2) Numerical Method, by E. Balagurusamy, Tata McGraw-Hill Publishing Co. Ltd.
- (3) Statistics Book/Numerical Analysis Book (Any)

10. Signature of the Course Teacher: Dr. Mohiuddin Ahmad & Dr. Md. Rejvi Kaysir